

Evaluation of Technologies to Prevent Precipitation During Water Recovery from Urine

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The International Space Station (ISS) Urine Processor Assembly (UPA) experienced a hardware failure in the Distillation Assembly (DA) in October 2010. Initially the UPA was operated to recover 85% of the water from urine through distillation, concentrating the contaminants in the remaining urine. The DA failed due to precipitation of calcium sulfate (gypsum) which caused a loss of UPA function. The ISS UPA operations have been modified to only recover 70% of the water minimizing gypsum precipitation risk but substantially increasing water resupply needs. This paper describes the feasibility assessment of several technologies (ion exchange, chelating agents, threshold inhibitors, and Lorentz devices) to prevent gypsum precipitation. The feasibility assessment includes the development of assessment methods, chemical modeling, bench top testing, and validation testing in a flight-like ground UPA unit. Ion exchange technology has been successfully demonstrated and has been recommended for further development. The incorporation of the selected technology will enable water recovery to be increased from 70% back to the original 85% and improve the ISS water balance.

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